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BROWDY AND NEIMARK, P.L.L.C.

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SUITE 300

624 NINTH STREET, N.W.

WASHINGTON, D. C. 20001-5303

TELEPHONE (202)-628-5197

ALVIN BROWDY (1917-1998)
SHERIDAN NEIMARK
ROGER L. BROWDYANNE M. KORNBAU
NORMAN J. LATKEROF COUNSEL
IVER P. COOPERTELECOPIER FACSIMILE
(202) 737-3528
(202) 393-1012E-MAIL
mail@browdyneimark.comPATENT AGENT
ALLEN C. YUN, PH.D.jc685 U.S. PTO
09/21/00
58899/60

September 21, 2000

Hon. Commissioner for Patents
Box Patent Appln
Washington, D.C. 20231Re: New Patent Application in U.S.
Applicant: Yehuda BINDER
Title: TELEPHONE COMMUNICATION SYSTEM AND METHOD OVER...
Atty's Docket: BINDER 10

Sir:

Attached herewith is the above-identified application for Letters Patent including:

- [X] Specification (15 pages), claims (7 pages) and abstract (1 page)
- [X] 9 Sheet Drawings (Figures 1A-7D)
- [X] Formal [] Informal
- [X] Declaration and Power of Attorney (2 pages)
- [X] Newly executed [] Copy from prior application no. ____
- [] Preliminary Amendment
- [] Computer-readable Sequence Listing
- [] Supplemental Preliminary Amendment adding new claims -
- [X] Information Disclosure Statement with 1449 and 15 references
- [X] A verified statement to establish small entity status under 37 CFR §1.9 and 37 CFR §1.27 (2 pages)
- [X] Please charge my American Express Account Form PTO-2038 attached in the amount of \$ 525.00 to cover:
- [X] The filing fee calculated as follows (including any preliminary amendment for entry prior to calculation of the filing fee):

CLAIMS AS FILED				
FOR	NUMBER FILED	NUMBER EXTRA	RATE	BASIC FEE
				\$ 690.00
TOTAL CLAIMS	27 - 20	= 7	x 18	\$ 126.00
INDEPENDENT CLAIMS	6 - 3	= 3	x 78	\$ 234.00
[] Multiple Dependent Claim Presented			+ 260	--
[X] Reduction of 1/2 for Small Entity				\$ 525.00
TOTAL FILING FEE				\$ 525.00

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In re of Yehuda BINDER (BINDER 10)

[] Any additional fee required by the filing of an enclosed preliminary or supplemental preliminary amendment (for entry after calculation of the filing fee) has been calculated as shown below:

	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NO. PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE	CALCULATION
TOTAL		-	=	x 18	
INDEP.		-	=	x 78	
[] Multiple Dependent Claim Presented				+ 260	
[] Reduction by 1/2 for Small Entity					
Total Additional Fee =					

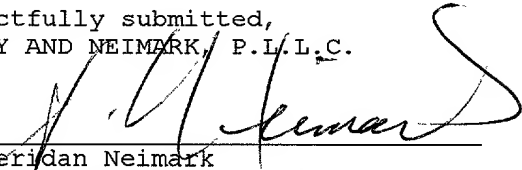
- [] Other Fees: _____.
- [] Other Attachments: _____.
- [X] Return Receipt Postcard (in duplicate)

The following statements are applicable:

- [] The benefit under 35 USC §119 is claimed of the filing date of: Application No. _____ in _____ on _____. A certified copy of said priority document [] is attached [] was filed in progenitor case _____ on _____.
- [] The present application is a Continuation Divisional Continuation-in-part of prior claims the benefit of U.S. Provisional application no. , filed .
- [] Incorporation By Reference. The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied herewith, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
- [] A signed statement deleting inventor(s) named in the prior application is attached.
- [] The prior application was assigned to: _____
- [] Amend the specification by inserting before the first line the sentence:
--This is a continuation/division/continuation-in-part claims the benefit of U.S. Provisional of copending parent application Serial No. , filed .--
- [] Certain documents were previously cited or submitted to the Patent and Trademark Office in the following prior application _____, which is relied upon under 35 USC §120. Applicants identify these documents by attaching hereto a form PTO-1449 listing these documents, and request that they be considered and made of record in accordance with 37 CFR §1.98(d). Per Section 1.98(d), copies of these documents need not be filed in this application.

- [] A verified statement claiming small entity status is enclosed in progenitor application no. , filed . Status is still proper and desired.
- [] The undersigned attorney of record hereby revokes the powers of attorney of:
- [] The undersigned attorney of record hereby appoints associate power of attorney, to prosecute this application and to transact all business in the Patent and Trademark Office in connection therewith to:
- [X] The Commissioner is hereby authorized to charge payment of the following additional fees associated with this communication or credit any overpayments to Deposit Account No. 02-4035:
[X] Any additional filing fees required under 37 CFR §1.16.
[X] Any patent application processing fees under 37 CFR §1.17.
- [X] The Commissioner is hereby authorized to charge payment of the following fees, based on any paper filed during the pendency of this application or any CPA thereof, to effect any amendment, petition, or other action requested in said paper or credit any overpayments to Deposit Account No. 02-4035:
[X] Any patent application processing fees under 37 CFR §1.17.
[] The issue fee set in 37 CFR §1.18 at or before mailing the Notice of Allowance, pursuant to 37 CFR §1.311(b).
[X] Any filing fees under 37 CFR §1.16 for presentation of extra claims.
[X] If a paper is untimely filed in this or any CPA thereof by Applicant(s), the Commissioner is hereby petitioned under 37 CFR. §1.136(a) for the minimum extension of time required to make said paper timely. In the event a petition for extension of time is made under the provisions of this paragraph, the Commissioner is hereby requested to charge any fee required under 37 CFR §1.17 to Deposit Account 02-4035.
- [X] The Commissioner is hereby authorized to credit any overpayment of fees accompanying this paper to Deposit Account No. 02-4035.

Respectfully submitted,
BROWDY AND NEIMARK, P.L.L.C.

By: 
Sheridan Neimark
Registration No. 20,520

SN: wrd
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**VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY
STATUS (37 CFR 1.9(f) AND 1.27 (c)) - SMALL BUSINESS CONCERN**

Docket No.

Serial No.

Filing Date

Patent No.

Issue Date

Applicant/

Patentee: **BINDER, Yehuda**

Invention: **TELEPHONE COMMUNICATION SYSTEM AND METHOD OVER LOCAL AREA NETWORK
WIRING**

I hereby declare that I am:

- ☐ the owner of the small business concern identified below:
☒ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN: **SERCONET LTD.**

ADDRESS OF CONCERN: **16 Ha'Haroshet St., P.O.B. 2009, Raanana 43657, Israel**

I hereby declare that the above-identified small business concern qualifies as a small business concern as defined in 37 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the above identified invention described in:

- ☒ the specification filed herewith with title as listed above.
☐ the application identified above.
☐ the patent identified above.

If the rights held by the above-identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed on the next page and no rights to the invention are held by any person, other than the inventor, who could not qualify as an independent inventor under 37 CFR 1.9(c) or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- ☒ no such person, concern or organization exists.
☐ each such person, concern or organization is listed below.

FULL NAME
ADDRESS

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

FULL NAME
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☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING:

BINDER Yehuda

TITLE OF PERSON SIGNING

OTHER THAN OWNER:

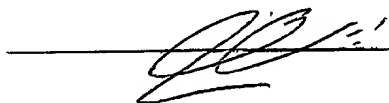
C.E.O.

ADDRESS OF PERSON SIGNING:

30 Yeshurun St.

Hod Hasharon 45200 / Israel

SIGNATURE:



DATE:

18 September 2000

**Telephone communication system and method
over local area network wiring**

FIELD OF THE INVENTION

The present invention relates to the field of common networks for data communication and telephony, and, more specifically, to the networking of telephone sets within a building over digitally oriented local area network wiring, simultaneously with the data transmission.

BACKGROUND OF THE INVENTION

Small office and business environments commonly employ a multiplicity of work cells, each equipped with a telephone set and a computer. Two separate networks are usually employed for communication among the cells and between them and the outside world - a telephone network, connecting between the telephone sets and outside telephone lines, and a so-called local area network (LAN), connecting the computers among themselves and to outside network lines.

The term computer or personal computer will be understood to include a workstation or other data terminal equipment (DTE) or at least one digital device capable of inputting and outputting data, whereby each computer includes an interface for connection to a local area network (LAN), used for digital data transmission; any such device will also be referred to as a remote digital device. The term telephone set will be understood to include any device which can connect to a PSTN (Public Switched Telephone Network), using telephony band signals, such as fax machine, automatic answering machine or dial-up modem; any such device will also be referred to as a remote- or local telephone device.

Such an environment is depicted in Figs. 1a and 1b, which show a typical small office/business configuration, requiring two separate and independent networks. Fig. 1a shows a telephony network **10** comprising a PABX (Private Automatic Branch Exchange) **11**, connected via lines **12a**, **12b**, **12c** and **12d** to telephone devices **13a**, **13b**, **13c** and **13d** respectively. The telephone are of the POTS (Plain Old Telephone Service) type, requiring each of the connecting lines **12** to consist of a single pair of wires.

Fig. 1b shows a local area network (LAN) **15** for allowing communication between computers. Such a network comprises a hub (or switching hub) **16**, connected via lines **17a**, **17b**, **17c** and **17d** to computers **18a**, **18b**, **18c** and **18d** respectively. Popular types of LANs are based on the IEEE802.3 Ethernet standard, using 10BaseT or 100BaseTX interfaces and employing, for each connecting line **17**, two twisted pairs of wires – one pair for transmitting and one pair for receiving.

Installation and maintenance of two separate networks is complicated and expensive. It would therefore be advantageous, especially in new installations, to have a combined wiring network system that serves both telephony and data communication requirements.

One approach is to provide a LAN only, which serves for normal inter-computer communication, and make it serve also for telephony. One general method for this approach, in common usage today, utilizes so-called Voice-Over-Internet-Protocol (VoIP) techniques. By such techniques, known in the art, telephone signals are digitized and carried as data in any existing LAN. Systems employing such techniques are, however, complex and expensive, and the quality of the voice carried by currently available technology is low.

Another, opposite approach is to utilize an existing telephone infrastructure for simultaneously serving as both telephone and data networking. In this way, the task of establishing a new local area network in a

home or other building is simplified, because there are no additional wires to install.

U.S. Patent 4,766,402 to Crane teaches a way to form a LAN over two-wire telephone lines, but without the telephone service.

5 The concept of frequency division multiplexing (FDM) is well-known in the art, and provides a means of splitting the inherent bandwidth of a wire into a low-frequency band, capable of carrying an analog telephony signal, and a high-frequency band, capable of carrying data or other signals. Such a technique, sometimes referred to as ‘data over voice’, is described, for
10 example, in U.S. Patents 5,896,443, 4,807,225, 5,960,066, 4,672,605, 5,930,340, 5,025,443 and 4,924,492. It is also widely used in xDSL systems, primarily Asymmetric Digital Subscriber Loop (ADSL) systems.

15 A typical system employing FDM is illustrated in Fig. 2, which shows schematically a combined telephony/data network **20**, providing in this case connections to two work cells by means of corresponding two cables **12a** and **12b**, each comprising a single twisted pair of wires. The lower part of the spectrum of cable **12a** is isolated by Low Pass Filters (LPF) **22a** and **22b**, each connected to a respective end of the cable. Similarly, the higher part of the spectrum is isolated by respective High Pass Filters (HPF) **21a** and **21b**. The
20 telephony network uses the lower spectrum part by connecting the telephone **13a** and the PABX **11** to the respective LPFs. In order to use the higher part of the spectrum for data communication, telephone-line modems **23a** and **23b** are respectively connected to the HPFs **21a** and **21b** at both cable ends. Hub **16** connects to modem **23a**, while, on the user side, modem **23b** connects to
25 computer **18a**, thus offering connectivity between the computer and the hub. The spectrum of the other cable **12b** is similarly split and cable **12b** connects telephone set **13b** to PABX **11** via LPFs **22c** and **22d**, while computer **18b** connects to hub **16** via modem **23d**, coupled to HPF **21d**, and modem **23c**, coupled to HPF **21c**. Additional telephones **13** and computers **18** can be added

in the same manner. This prior-art concept is disclosed in U.S. Patent 4,785,448 to Reichert *et al.* (hereinafter referred to as "Reichert") and U.S. Patent 5,841,841 to Dodds *et al.* (hereinafter referred to as "Dodds"). Both Reichert and Dodds suggest a method and apparatus for applying frequency domain/division multiplexing (FDM) technique for residential telephone wiring, enabling simultaneously carrying telephone and data communication signals, as described above.

Network **20**, employing an FDM method, typically requires two modems (such as **23a** and **23b** in Fig. 2) for each connected cell. Such modems are complex and expensive. In addition, the low communication quality of a typical telephone line, which was designed to carry low-frequency (telephony) signals only, limits both the data-rate and the distance of the data communication.

The concept of forming a phantom channel to serve as an additional path in a two wire-pairs communication system is known in the art of telephony, and disclosed in several patents, classified under U.S. Class 370/200. Commonly, such a phantom channel path is used to carry power to feed remote equipment or intermediate repeaters. In some prior-art systems, exemplified by U.S. Patents 4,173,714, 3,975,594, 3,806,814, 6,026,078 and 4,937,811, the phantom channel is used to carry additional signals, such as metering and other auxiliary signals. Thus, all such systems use the phantom channel only as means for helping the communication service over the main channels. None of the mentioned prior-art uses the phantom channel for carrying an additional communication type of service, or for functionally combining two distinct networks.

It would thus be desirable to allow a data networking system to simultaneously also provide telephone service without any additional wiring.

SUMMARY OF THE INVENTION

It is an object of the invention to allow a data networking system to simultaneously also provide telephone service without any additional wiring.

This object is realized in accordance with a broad aspect of the invention
5 by a communication network for providing simultaneous digital data- and analog telephone communication between a central location and at least one remote location, the communication network comprising:

a central digital device,

a central telephone device and,

10 for each remote location – a remote digital device, a remote telephone device and a cable having a remote end at the respective remote location and a near end at the central location;

said cable including at least two pairs of conductors, each pair operative as a data channel for carrying data signals between said remote digital device
15 and said central digital device and said at least two pairs cooperatively forming a phantom channel, operative to carry telephone signals between said remote telephone device and said central telephone device.

Conventional data networks use a four-conductor circuit arrangement providing two communication channels between two units. For example, in a
20 local area network based on Ethernet 10BaseT or 100BaseTX, two pairs of conductors are employed between a hub and DTE such as a computer. By means of the invention, POTS connection, such as between exchange and telephone apparatus, is accomplished simultaneously over the same four conductors used for the two communication channels without interference. The
25 POTS service communication is accomplished via a phantom circuit arrangement over the four conductors.

Such configuration can be employed within small office or small business, wherein single wiring infrastructure is used for distributing both data and telephone signals from a central location, including a hub and an exchange

to a remote station, each such station comprising a telephone unit and a data unit (e.g. desktop computer).

The present invention also provides a circuit arrangement wherein a cable that includes two twisted-conductor pairs provides both a two-way data communication channel for a connected computer and, simultaneously, a path for POTS signal to and from a connected telephone set, using the phantom channel method. In the preferred embodiment, the data communication channel consists of an Ethernet IEEE802.3 LAN channel and 10BaseT, or 100BaseTX, interfaces.

According to the invention, each two-conductor pair is terminated at each of its ends with a center tapped primary transformer winding (hereinafter cable-side winding), whereby each conductor of the pair is connected to a respective end of the cable side winding. Each winding is inductively coupled to a secondary winding (hereinafter referred to as equipment side winding), whose ends are connected to another pair of conductors that form the continuation channel for the data carrying signal, wherein the equipment side winding is connected to the data communication equipment. The center taps of each of the two primary winding at any end of the cable are connectable to the respective conductors of a telephone circuit, to carry the POTS signals. Thus, the two pairs of conductors at opposite ends of the cable, through the center taps of the respective primary transformer windings, form first and second connections of the two conductor phantom channel, which is used for carrying the telephone signal.

The invention can be implemented by means of two modules — one at each end of the two-conductor-pairs cable. Each module comprises two transformers, with a center-tap in the primary (cable side) winding. The module retains the two-pair data communication capability, while simultaneously including a phantom channel via the center-tap connections, for telephone service. The phantom channel can be accessed via a connector in the module.

The module can be a stand-alone unit, or integrated within any unit in the network, such as a digital network hub, a telephone exchange, a server computer or telephone set. Alternatively, the module can be integrated within a wall outlet connected to one or both ends of the cable.

5 In another embodiment, the modules form a kit, which is used to upgrade an existing local area network to support telephone networking also.

10 The invention can be used in a small office or small business environment, which has a central location that comprises a telephone exchange and a digital network concentration unit (such as a hub, a switch or a router), connected to multiple remote work stations via LAN wiring.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to understand the invention and to see how it may be carried out in practice, a preferred embodiment will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

15 **Figs. 1a and 1b** show respectively a common prior art telephone and Local Area Network configuration as used within a small office or a small business;

20 **Fig. 2** shows a prior art telephone and local area networks using the telephone-wiring infrastructure;

Fig. 3 shows a combined telephone and data communication network according to the present invention;

Fig. 4 shows schematically a data communications network having multiple phantom channels according to the present invention all sharing a common return;

25 **Fig. 5a** shows schematically a computer modified according to the invention for direct coupling to a telephone set;

Fig. 5b shows schematically a telephone set modified according to the invention for direct coupling to a computer;

Fig. 6 shows modified wall outlet that adds a phantom channel telephone service to an existing data communication system according to the present invention; and

Figs. 7a to 7d show different views of an attachable wall plug connector that adds a phantom channel telephone service to an existing data communication system according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

In the following description it is to be noted that the drawings and descriptions are conceptual only. In actual practice, a single component can implement one or more functions; alternatively, each function can be implemented by a plurality of components and circuits. In the drawings and descriptions, identical reference numerals are use to indicate those components that are common to different embodiments or configurations.

Fig. 3 illustrates a preferred embodiment of the present invention. The network **30** is a part of an IEEE802.3 local area network, using 10BaseT interfaces. A hub **16**, defining a central location, is connected to a typical computer **18a** via a cable that includes two wire pairs **17a1** and **17a2**. Each pair is operative to carry data in one direction only, one pair, say **17a1**, carrying data from the hub **16** to the computer **18a**, while the other pair, **17a2**, carries data in the other direction. Fig. 3 also shows a telephone set **13a**, associated with computer **18a** and preferably near it, and a telephone private automatic branch exchange (PABX) **11**, which is preferably also at the central location. The term hub is used herein to represent any digital network concentrating unit and may equally refer to a switching hub, a router, a server computer or to any digital device having multiple data ports; any of these being also referred to herein as a central digital device. Similarly, PABX is used herein to represent any type of central telephone switching unit and will also be referred to as a central telephone device.

According to the invention, a signal transformer is inserted at each end of each wire pair, whereby, for example, transformer **31a1** is inserted at the end of wire pair **17a1** that is near hub **16** and transformer **31b1** is inserted at the end of wire pair **17a1** that is near computer **18a**. Similarly, transformers **31a2** and **31b2** are inserted at the ends of wire pair **17a2** that are near hub **16** and computer **18a**, respectively. The signal transformers bearing the prefix **31** are designed so that the signal attenuation via these transformers is negligible. Hence, the performance of the data communication network is fully retained, and the hub **16** continues to communicate fully with the computer **18a** in the usual manner. Such transformers are known in the art and are often used in LANs, in order to meet isolation and common-mode rejection requirements. Commonly, such signal transformers are equipped with a primary winding and a secondary winding both being untapped coils. In the invention, each signal transformer bearing the prefix **31**, say **31a2** has a primary winding **35**, whose ends are connected to the respective wires of the cable, and a secondary winding **36**, whose ends are connected to the respective system component (hub **16** or computer **18a**).

However, unlike the conventional configuration for signal transformers, according to the present invention each primary winding **35** has a center-tap shown as **37a1** and **37a2**, for the two signal transformers **31a1** and **31a2**, respectively. PABX **11** is connected, via two respective wires **38a**, to the center-taps **37a1** and **37a2** of transformers **31a1** and **31a2**. Similarly, the telephone set **13a** is connected, via two respective wires **38b**, to the center-taps **37b1** and **37b2** of transformers **31b1** and **31b2**, respectively. In this configuration, the telephony signals are carried in a 'phantom' way together with the data communication signals, without any interference between the two. In practice, the hub side transformers **31a1** and **31a2** may be integrated to form a module **32a**, while the computer side transformers **31b1** and **31b2** may be integrated to form a module **32b**. While the network **30** has so far been

described as supporting a single computer and a single telephone, additional work cells, each comprising a telephone and a computer can be supported, whereby each computer is connected with hub **16** through a corresponding two wire pairs cable, by inserting an additional set of modules **32a** and **32b** in each such cable.

While the invention has been described specifically for 10BaseT (10Mb/s) interfaces, the invention can be equally applied to 100BaseTX (100Mb/s) interfaces. Furthermore, the invention can be equally applied in any wired networking system using at least two wire pairs. Transformers can be used in all wired communication systems whose signals do not include direct current (DC) components. In systems that use four or more pairs of wires, such as those based on the evolving 1000BaseTX Ethernet standard, each two pairs can be used to form a single phantom channel. Thus, four pairs can form two phantom channels, each carrying one POTS circuit, by terminating each pair with a transformer as described above. Alternatively and preferably, as shown in Fig. 4, three pairs **17a1**, **17a2** and **17a3** can each form a phantom channel with the fourth pair **17a4**, which serves as the common return path. In this case, each telephone circuit **13a**, **13b** and **13c** has one of its two wires connected to the center-tap **37b1**, **37b2** and **37b3** of the respective transformer **31b1**, **31b2** and **31b3** at the corresponding end of the respective pair and the other wire - to the center-tap **37b4** of the transformer **31b4** at the corresponding end of the common pair. More generally, with N pairs of conductors, each pair serving as a data channel, it is possible to similarly provide N-1 phantom channels for telephone service.

In the configuration shown in Fig. 3 the modules **32a** and **32b** are stand-alone modules, mechanically separate from other components in the network. However, also other configurations are possible. For example, the hub side module **32a** can be integrated, fully or in part, within the hub **16**. In such a case, the hub's existing data connection-unit (such as a distribution frame - for

connecting thereto all line pairs) is preferably substituted by one that includes module **32a**; in addition, a telephone connector is provided, for connecting all telephone lines (whose other ends are connected to their respective center taps in module **32a**) to the PABX. Alternatively, module **32a** can be similarly
5 integrated within PABX **11**, whereby an appropriate connection with the hub is provided.

Fig. 5a shows schematically an arrangement where the computer side module **32b** is integrated, fully or in part, within the computer **18a**. Thus, the secondary windings **36** of the transformers **31a1** and **31a2** are connected to
10 receiver and transmitter circuitry **39a** and **39b** within the computer **18a**. The ends of the primary windings **35** of the transformers **31a1** and **31a2** are connected to a standard socket outlet **40** for connecting to the network. The center-taps **37a1** and **37a2** are connected to a standard telephone outlet **41**, enabling connection thereto of a telephone set such as designated **13a** in Fig. 3.

15 Fig. 5b shows schematically the complementary arrangement where the module **32b** is integrated the telephone set **13a**. Thus, the secondary windings **36** of the transformers **31a1** and **31a2** are connected to a standard outlet **42** for connecting thereto a computer such as designated **18a** in Fig. 3. The ends of the primary windings **35** of the transformers **31a1** and **31a2** are connected to a
20 standard socket outlet **43** for connecting to the network. The center-taps **37a1** and **37a2** are connected to telephone circuitry **44**, within the telephone set **13a**.

Alternatively, the computer side module **32b** can be integrated within a wall connector allowing direct or indirect connection to an existing wall socket outlet. Thus, such a wall connector can be constituted by a substitute wall
25 socket having integrated therein a pair of signal transformers and two female outlets for connecting a computer and telephone thereto, respectively. Alternatively, the wall connector can be constituted by a plug connector having integrated therein a pair of signal transformers and two female outlets for connecting a computer and telephone thereto, respectively. Such a plug

connector allows a computer and telephone to be connected to an existing wall socket outlet without requiring any modification thereto.

Fig. 6 shows the faceplate of a modified socket outlet 45 according to the invention. Two conductor pairs are connected to the outlet at the rear (not shown in the Figure), connected to the primary windings of two signals
5 transformers housed in it (not shown in the Figure). The secondary windings of the transformers are connected to RJ-45 data connector 46, while the center taps are connected to the RJ-11 telephony connector 47. Such an outlet is physically similar in size, shape, and overall appearance to a standard outlet, so
10 that such an outlet can be substituted for a standard outlet in the building wall. No changes are required in the overall LAN line layout or configuration. Such an outlet can easily substitute an existing standard data outlet to thus additionally provide telephony support. Thus a conventional outlet has a single female connector having two pairs of wiper contacts connected to the
15 respective twisted-wire pairs for data transmission and reception. A computer is plugged into such a conventional outlet via a single male connector (plug) having four pins: two for handling data transmission and two for handling data reception. On inserting the plug into the socket outlets, the pins brush against the wiper contacts in the socket outlet, thus establishing electrical connection
20 between the two.

The invention allows for the conventional outlet to be replaced by a modified outlet having therein a pair of signal transformers, the ends of whose respective primary windings are adapted to be connected to the ends of a respective conductor pair in the network. The secondary winding of each signal
25 transformer is connected internally to a respective pair of wiper contacts of a first female connector. Thus, the ends of both secondary windings are connected to first female connector by means of four wiper contacts in total. The respective center-taps of each of the two primary windings are connected to a pair of wiper contacts in a second female connector proximate the first

female connector. Thus, a computer can be connected, via four pins of a suitable jack plug, to the first female connector, while a telephone can be connected, via two pins of a suitable jack plug to the second female connector. The two wire pairs **17a1** and **17a2** are routed and connected to such an outlet, which will now comprise two faceplate connectors – a data connector (e.g. RJ-45 for 10BaseT) and a telephone connector (e.g. RJ-11).

Such an implementation requires that the socket outlets in an existing data network be replaced by a modified outlet according to the invention. Figs. 7a to 7d show various views of a plug assembly **50** according to the invention for operation in 10BaseT or 100BaseTX environment that allows the invention to be implemented without requiring any modification to the data network or to the existing socket outlet. In use, the plug assembly **50** is plugged into a standard socket outlet and is retained therein by means of a latch **51**. The plug assembly **50** contains the module **32b** connected to separate data- and telephony socket outlets **52** and **53** in a similar manner to the modified socket outlet **45** described above with reference to Fig. 6. A standard RJ45 jack plug **54** is connected to the module **32b** for mating with the wall outlet when plugged into its socket. The jack plug **54** thus includes two pairs of pins each connected to the primary winding of a respective signal transformer within the module **32b**. The secondary windings of the two signal transformers are connected to respective wiper contacts in the data-telephony socket outlet **52**. The respective center-taps of each of the primary windings are connected to a pair of wiper contacts in the telephony socket outlet **53** proximate the data-telephony socket outlet **52**. Cables from the computer and the telephone set terminate in standard jack plugs that are plugged into the respective data- and telephony socket outlets **52** and **53** within the plug assembly **50**. Thus, the plug assembly **50** obviates the need for any changes to be made to the existing infrastructure.

As mentioned above, 10BaseT and 100BaseTX interfaces, as well as other data communication interfaces, often include signal transformers in the line connection circuitry, in order to meet isolation and common-mode rejection requirements. In such cases, additional transformers, though possible,
5 are not required and the method of the present invention can be implemented by adding center-tap connections to the respective windings of the existing transformers and using them to form a phantom channel, to serve for telephone connection in the manner described above. Alternatively, the existing transformers can be substituted by ones with center-taps as specified above.

10 It is noted that, while a phantom channel has been known in the art, its use in the system and method disclosed herein is novel, because:

(a) Local area networks (LANs) in general, and Ethernet networks in particular, currently do not employ phantom channels, nor is any configuration employing such channels specified in the IEEE802.3 standards; the concept is
15 known in the realm of telephony only, which is very different from that of data communication LANs.

(b) Using a phantom channel itself to carry POTS service is not known in the art; rather, phantom channels are used only to carry power to remote units and/or management- or control signals to support the main service that is
20 provided by the two conductor pairs.

While the invention is described above relating to hub units, it is clear that any other multi-port data communication device can be used, such as switch, router or gateway.

The present invention also embraces a method for upgrading an existing
25 local area network (LAN) installation that includes a two-conductor pair cable between two digital devices, to also and simultaneously convey signals between two telephone devices, the method comprising:

(a) inserting a first pair of signal transformers having center-tapped primary windings at a first end of the cable, with respective ends of

the primary windings connected to respective conductors of the cable; and

- (b) inserting a second pair of signal transformers having center-tapped primary windings at a second end of the cable, with respective ends of the primary windings connected to respective conductors of the cable;

thereby allowing respective secondary windings of each signal transformer to be connected to the digital devices and allowing the respective center-taps of the signal transformers to be connected to telephone equipment.

If the LAN already includes signal transformers that do not have center-taps, they are, in step (a) above, replaced by the specified transformers or, alternatively, a center-tap is added to each primary winding.

While the invention has been described with respect to a limited number of embodiments, it will be appreciated that many variations, modifications and other applications of the invention may be made.

CLAIMS:

1. A communication network for providing simultaneous digital data- and analog telephone communication between a central location and at least one
5 remote location, the communication network comprising:

a central digital device,

a central telephone device and,

for each remote location - a remote digital device, a remote telephone
device and a cable having a remote end at the respective remote location and a
10 near end at the central location;

said cable including at least two pairs of conductors, each pair operative
as a data channel for carrying data signals between said remote digital device
and said central digital device and said at least two pairs cooperatively forming
a phantom channel, operative to carry telephone signals between said remote
15 telephone device and said central telephone device.

2. The network of claim 1, further comprising, for each remote location,
two signal transformers at each end of said cable, each signal transformer
having a primary winding and a secondary winding, the primary winding
20 having a center-tap, wherein the two conductors of each of said pairs are
connected at each of their ends to the ends of the primary winding of a
corresponding one of said transformers and wherein:

the ends of the respective secondary winding of each of said two
transformers at the remote end of said cable are connected to the respective
25 remote digital device;

the ends of the respective second winding of each of said two
transformers at the near end of said cable are connected to the central digital
device;

said center-taps of each of said two transformers at the remote end of said cable cooperatively form a remote port of said phantom channel and are connected to the respective remote telephone device; and

5 said center-taps of each of said two transformers at the near end of said cable cooperatively form a central port of said phantom channel and are connected to the central telephone device.

10 3. The network of claim 2, further comprising, for at least one remote location, a wall outlet, directly or indirectly attached to a wall and containing said two transformers for connecting to the remote end of said cable.

4. The network of claim 3, wherein said wall outlet is dimensioned to conform to an existing wall connector of a data communication network.

15 5. The network of claim 2, wherein, for at least one remote location, said two transformers at the remote end of said cable are directly or indirectly attached to, or housed inside, the respective remote digital device.

20 6. The network of claim 2, wherein, for at least one remote location, said two transformers at the remote end of said cable are directly or indirectly attached to, or housed inside, the respective remote telephone device.

25 7. The network of claim 2, wherein said transformers at the near ends of each cable are directly or indirectly attached to, or housed inside, the central digital device.

8. The network of claim 2, wherein said transformers at the near ends of each cable are directly or indirectly attached to, or housed inside, the central telephone device.

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9. The network of claim 1, wherein each of said data channels conforms to the IEEE802.3 standard.

5 10. A circuit for providing simultaneous data- and telephone communication between two locations, said circuit comprising:

10 a plurality of pairs of conductors, opposite ends of each pair of conductors being at respective ones of the two locations and each pair operative as a respective data channel for carrying data signals between the two locations;

at least two of said pairs cooperatively forming at least one phantom channel, operative to carry telephone signals between the two locations.

15 11. The circuit of claim 10, further comprising a signal transformer at each end of each of said at least two pairs of conductors, each signal transformer having a primary winding and a secondary winding, the primary winding having a center-tap, wherein:

20 said at least two pairs of conductors are connected at each of their ends to respective ends of the primary winding of a respective signal transformer, and

respective ends of the secondary winding of each of said signal transformers form connection points to a corresponding one of said data channels and said center-taps form connection points to a corresponding one of said at least one phantom channel.

25 12. The circuit of claim 10, including at least two pairs of conductors and a single phantom.

30 13. The circuit of claim 10, wherein said plurality of pairs is N pairs and said at least one phantom channel is N-1 phantom channels.

14. For a digital data communication network that comprises at least one cable between a first and a second location, each cable including at least two pairs of conductors, each pair providing a data communication channel between
5 respective digital devices at the two locations - a kit for additionally and simultaneously providing, over said at least two pairs of conductors of any of the at least one cable, a telephone channel between respective telephone devices, said kit comprising at least two pairs of signal transformers, at least one pair for each end of the cable, and each having a primary winding and a
10 second winding, the primary winding having a center-tap, wherein:

respective ends of the primary winding of each of said signal transformers are adapted to be connected to a respective end of said pairs of conductors,

respective ends of the secondary winding of two of said signal
15 transformers are adapted for connection to a remote digital device, and

respective center-taps of each of pair of signal transformers are adapted for connection to a respective telephone device.

15. The kit of claim 14, wherein at least one pair of signal transformers is
20 housed in a discrete module.

16. The kit of claim 15, wherein the discrete module is packaged in a wall connector which is directly or indirectly attachable to a surface of a building.

25 17. The kit of claim 15, wherein the wall connector is dimensioned to conform to an existing wall connector of a data communication network.

18. The kit of claim 15, wherein the wall connector includes:

a first female connector having at least two pairs of contacts and a second female connector having at least one pair of contacts disposed proximate the first female connector,

5 at least one pair of signal transformers, each having a primary winding whose ends are adapted to be connected to respective conductor pairs,

a secondary winding of each signal transformer connected to a respective one of the pair of contacts of the first female connector, and

10 respective center-taps of each of the two primary windings connected to a corresponding pair of the at least one pair of contacts in the second female connector.

19. The kit of claim 18, wherein the wall connector is a substitute socket outlet.

15

20. The kit of claim 18, wherein the wall connector is a plug assembly further including:

20 a plug having at least two pairs of contacts each connected to the primary windings of a respective one of the signal transformers for removably coupling with a socket outlet of a data network.

21. A digital device, connectable to at least two pairs of conductors for conveying data therethrough to and from at least one other digital device, the digital device being also connectable to at least one local telephone device and
25 operative to transmit signals between said at least one local telephone device and at least one other telephone device over said at least two pairs of conductors in a phantom channel mode.

22. The digital device of claim 21, comprising at least two signal transformers, each having a center-tapped primary winding, whose ends are connectable to a corresponding one of said pairs of conductors and whose center-tap is connectable to said at least one local telephone device.

5

23. A combination outlet for pluggably connecting a digital device and a telephone device to respective ends of at least two conductor pairs so as to be able to simultaneously convey data signals to and from the digital device and telephone signals to and from the telephone device, the outlet comprising:

10 a first female connector having at least two pairs of contacts and a second female connector having at least one pair of contacts disposed proximate the first female connector,

at least one pair of signal transformers, each having a primary winding whose ends are adapted to be connected to respective conductor pairs,

15 a secondary winding of each signal transformer connected to a respective one of the pair of contacts of the first female connector, and

respective center-taps of each of the two primary windings connected to the pair of contacts in the second female connector.

20 24. The combination outlet of claim 23, being dimensioned to conform to an existing wall connector of a data communication network.

25 25. The combination outlet of claim 23, being disposed within a plug assembly further including:

a plug having at least two pairs of contacts each connected to the primary windings of a respective one of the signal transformers for removably coupling with a socket outlet of a data network.

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5 **(a)** providing a first connection of a phantom channel in association
with the at least two pairs of conductors at a first end thereof, and
(b) providing a second connection of a phantom channel in association
with the at least two pairs of conductors at a second end thereof;
thus allowing two telephone devices to be connected to the first and
0 second phantom channels respectively.

15 (i) inserting a first pair of signal transformers having center-tapped primary windings at a first end of the cable, with respective ends of the primary windings connected to respective conductors of the cable; and

(ii) inserting a second pair of signal transformers having center-tapped primary windings at a second end of the cable, with respective ends of the primary windings connected to

20 respective conductors of the cable;

thereby allowing respective secondary windings of each signal transformer to be connected to the digital devices and allowing the respective center-taps of the signal transformers to be connected to telephone equipment.

A method and apparatus for enabling a local area network wiring structure to simultaneously carry digital data and analog telephone signals on the same transmission medium. It is particularly applicable to a network in star topology, in which remote data units (e.g. personal computers) are each connected to a hub through a cable comprising at least two pairs of conductors, providing a data communication path in each direction. Modules at each end of the cable provide a phantom path for telephony (voice band) signals between a telephone near the data set and a PBX, through both conductor pairs in a phantom circuit arrangement. All such communication paths function simultaneously and without mutual interference. The modules comprise simple and inexpensive passive circuit components.

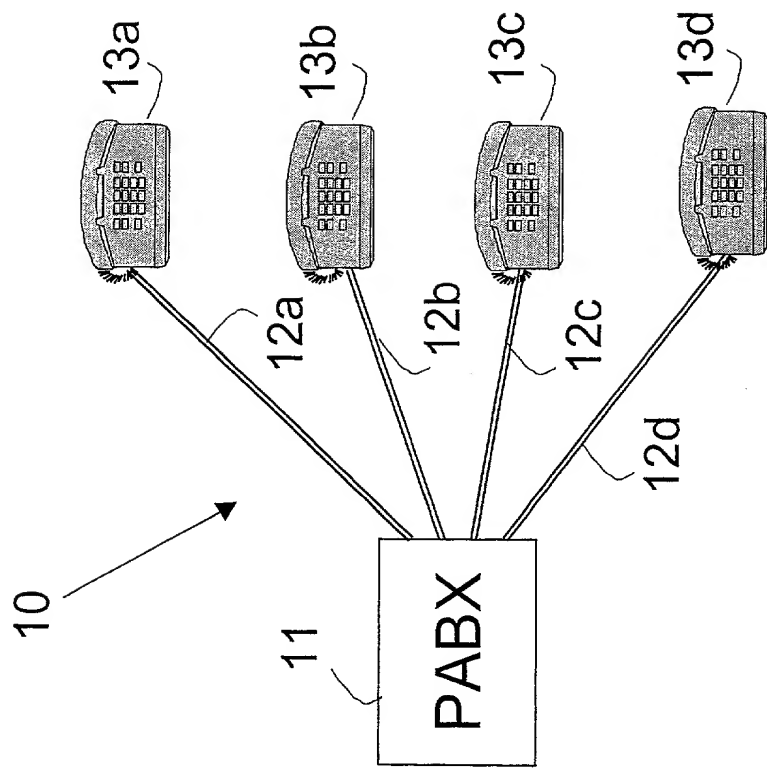


Fig. 1a (Prior-Art)

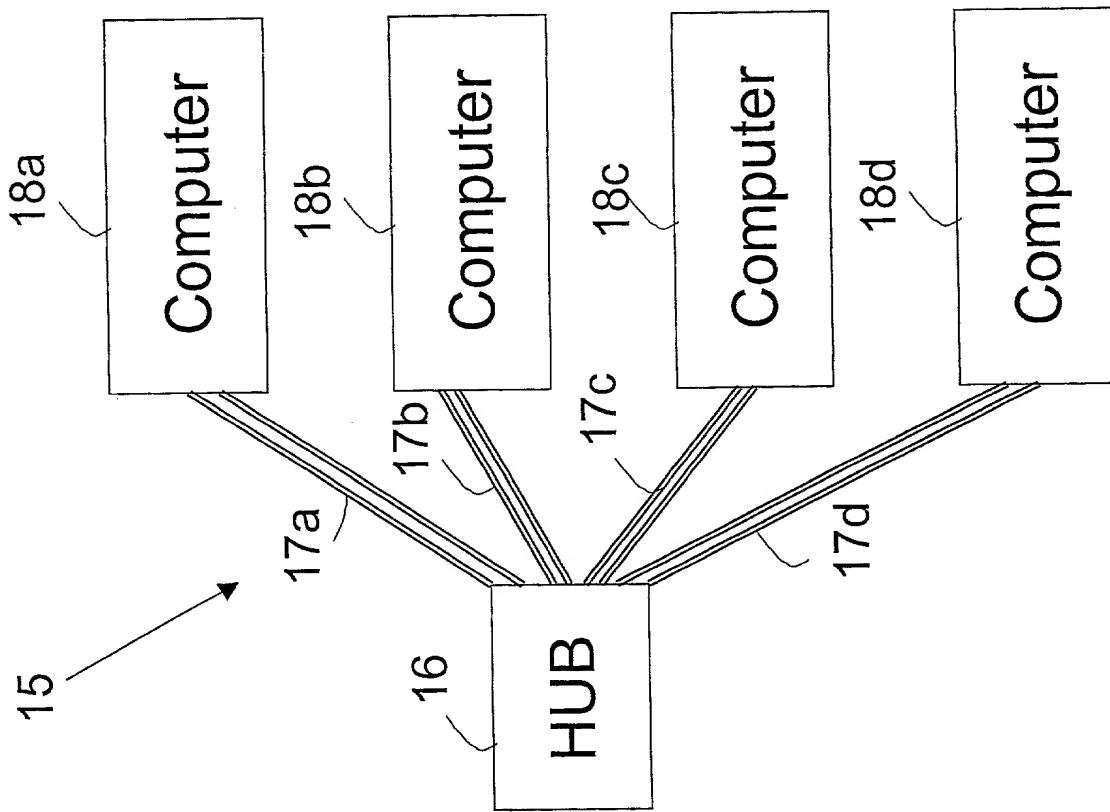


Fig. 1b
(Prior-Art)

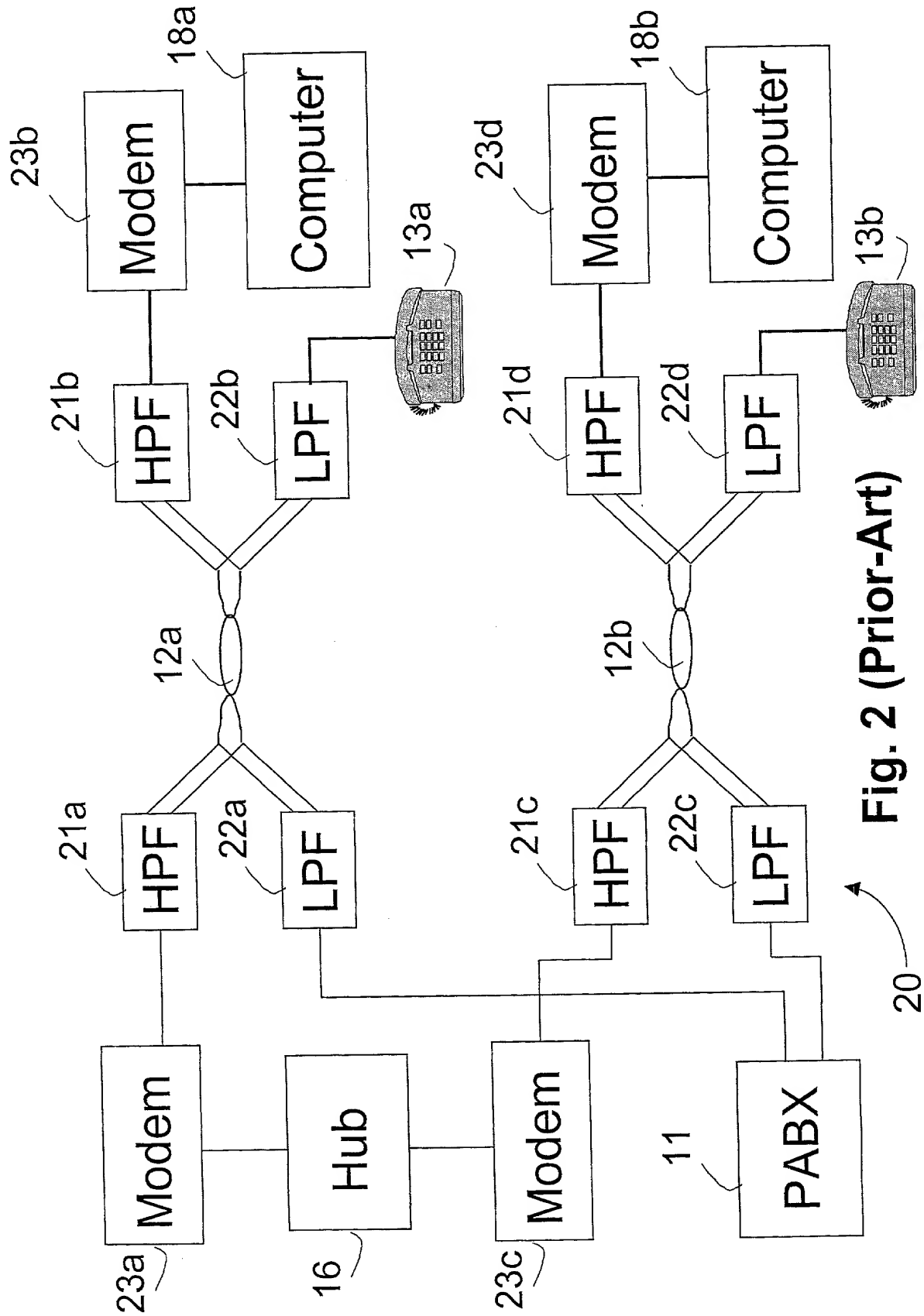


Fig. 2 (Prior-Art)

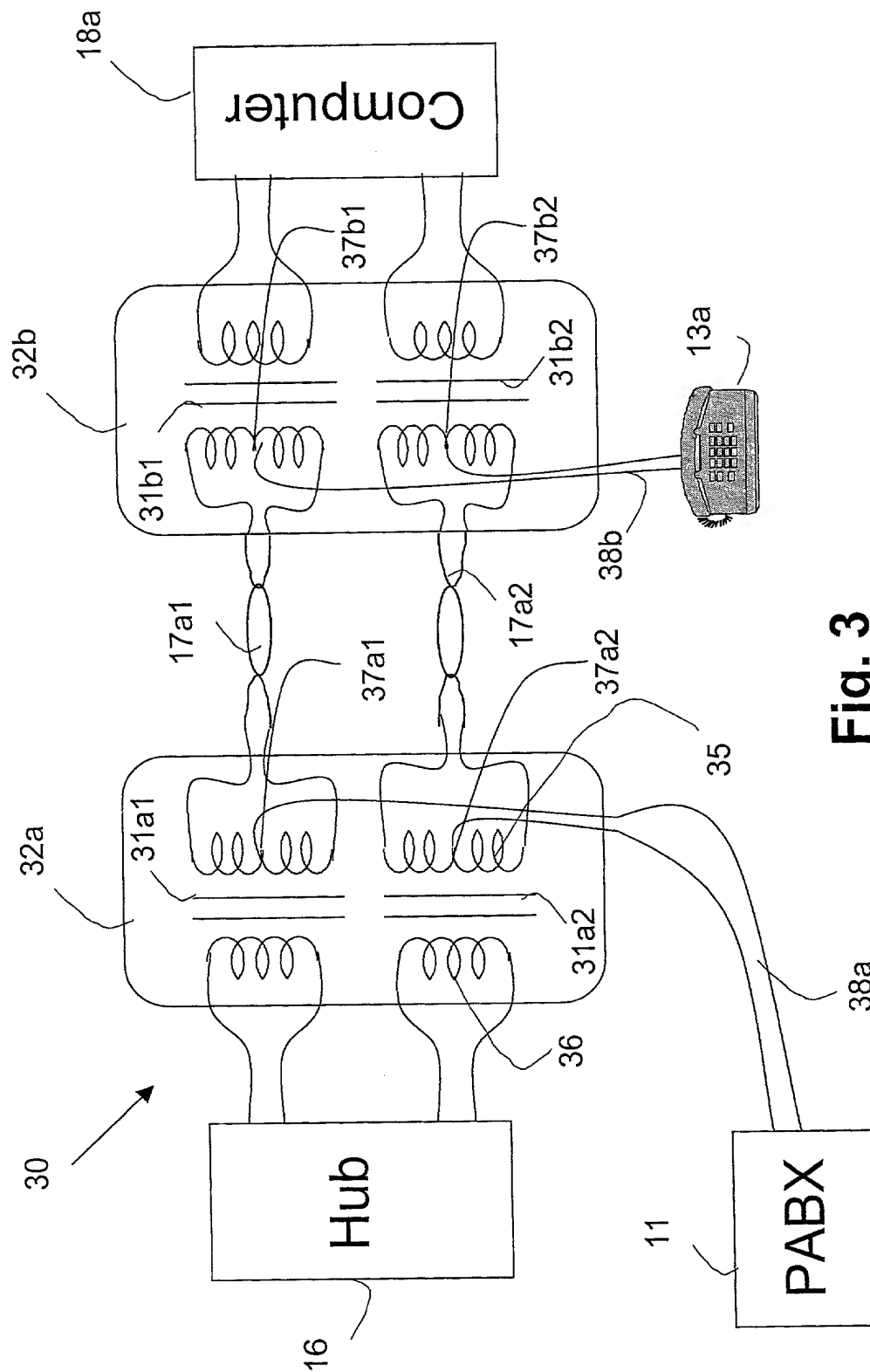


Fig. 3

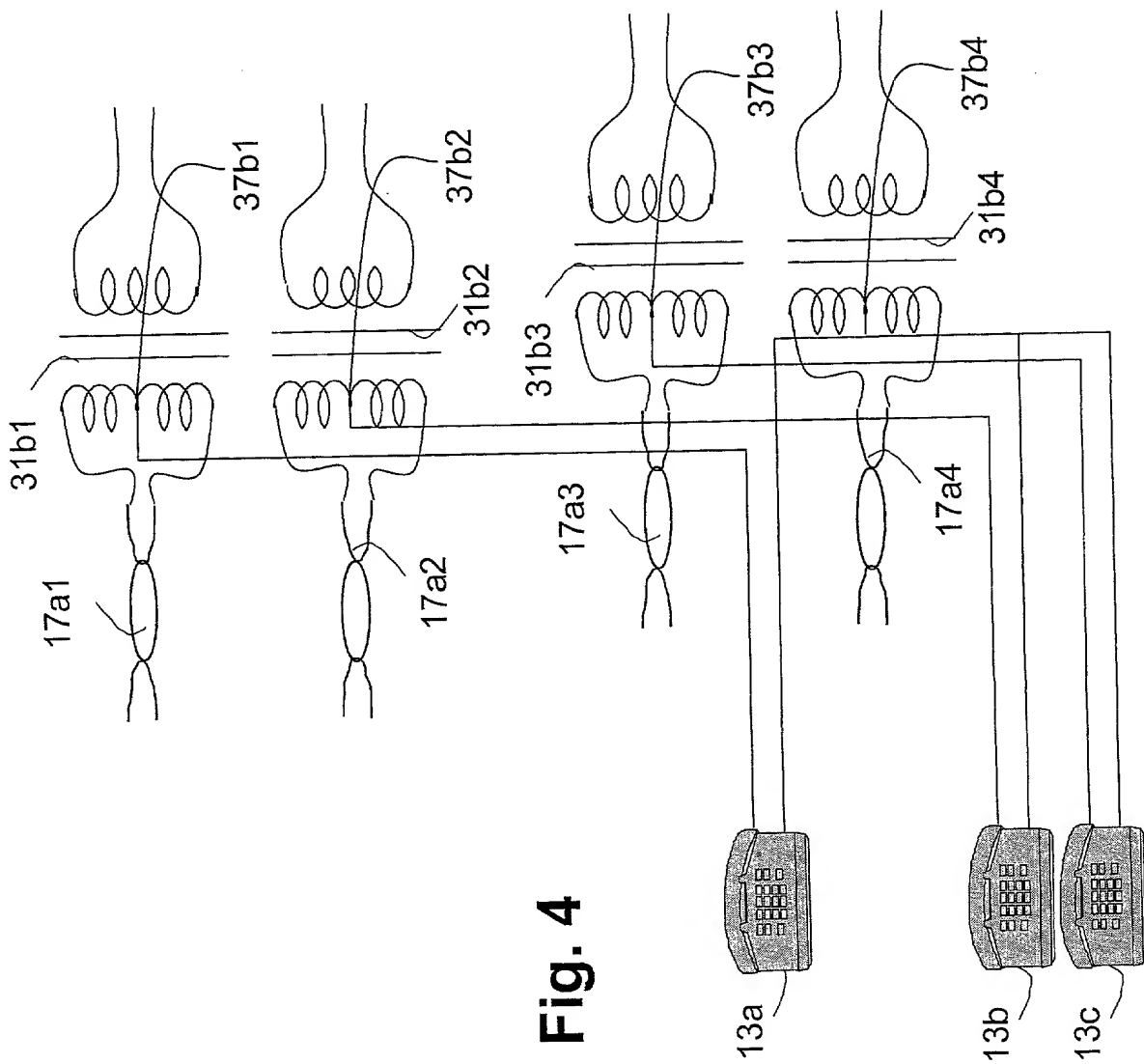


Fig. 4

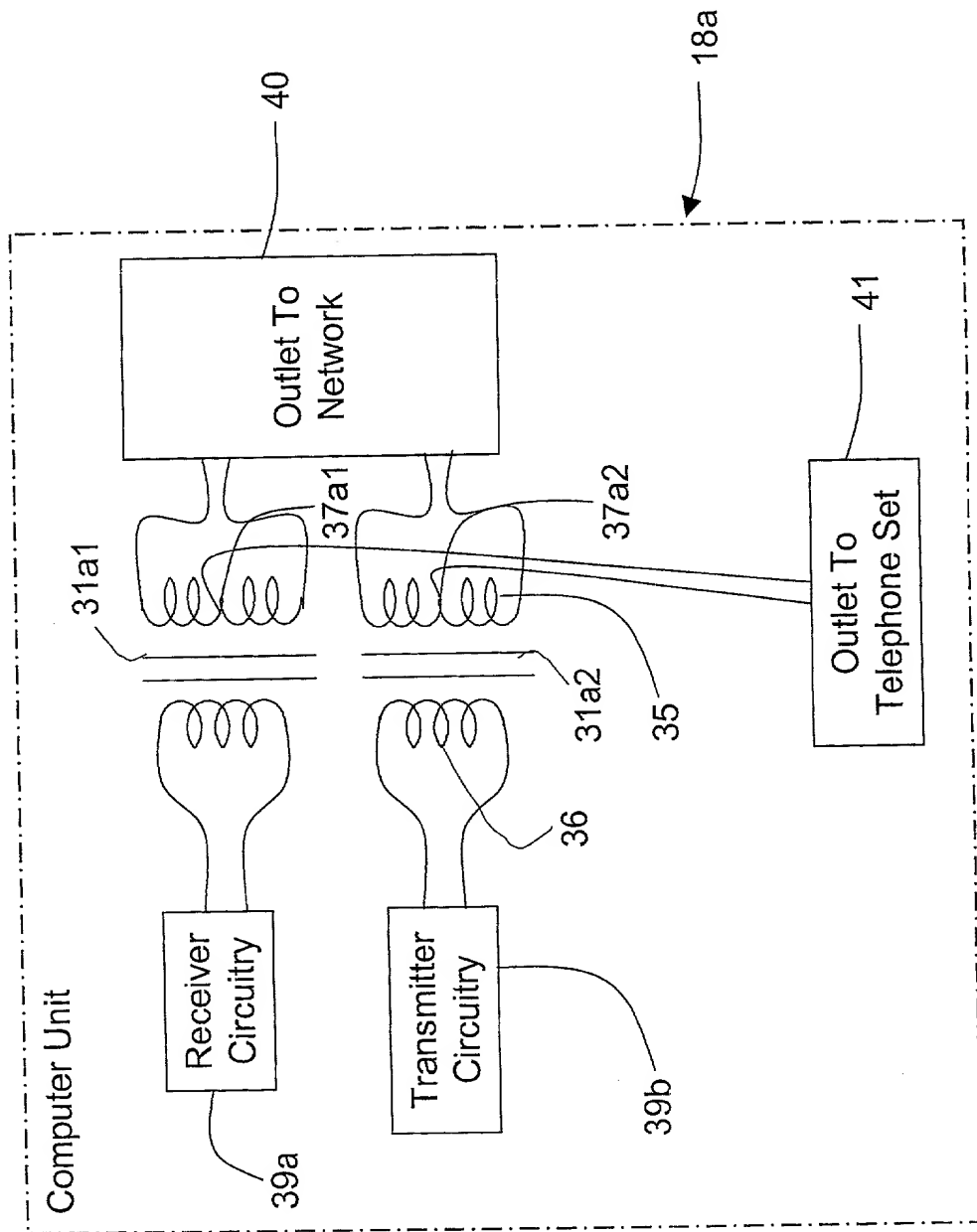


Fig. 5a

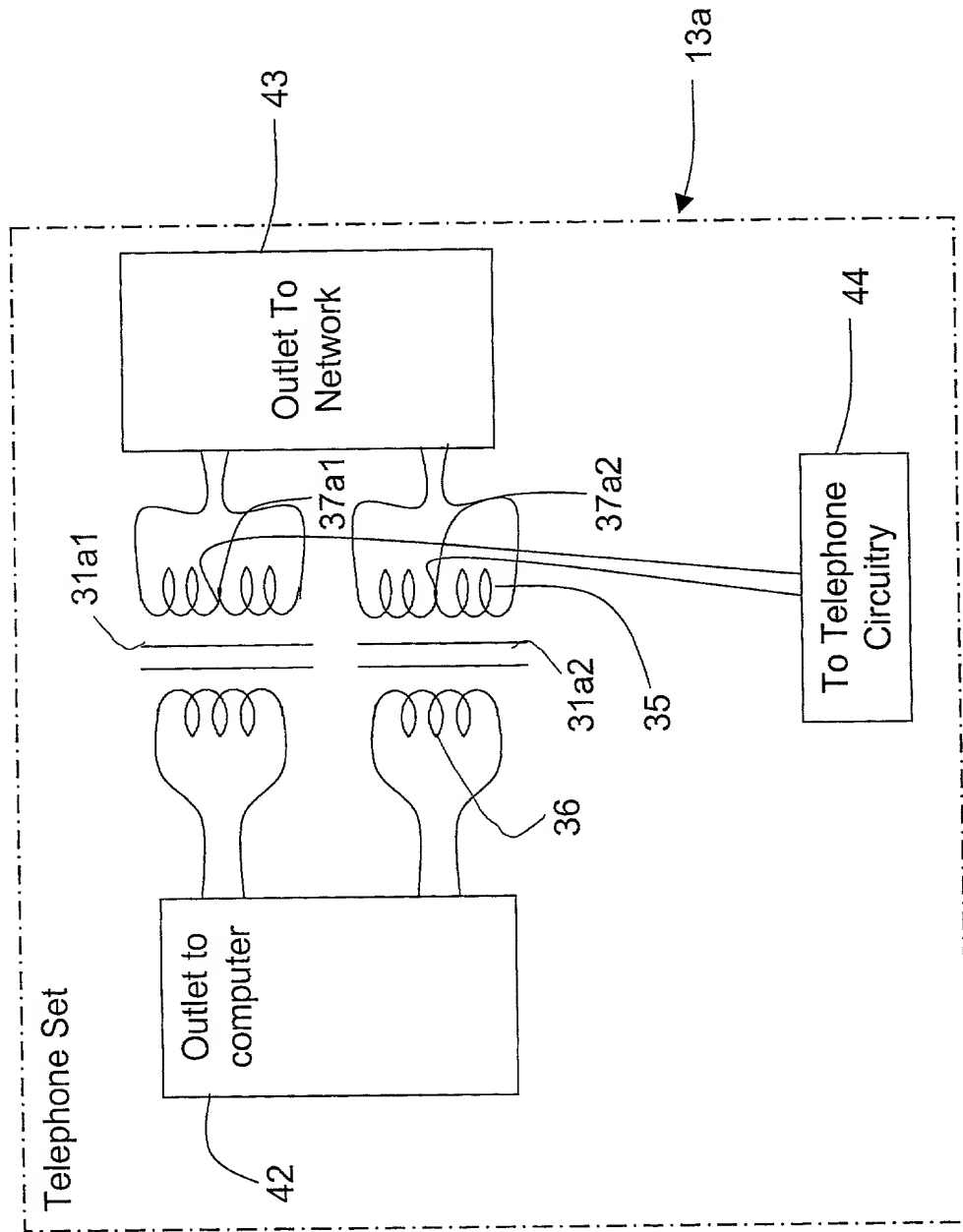


Fig. 5b

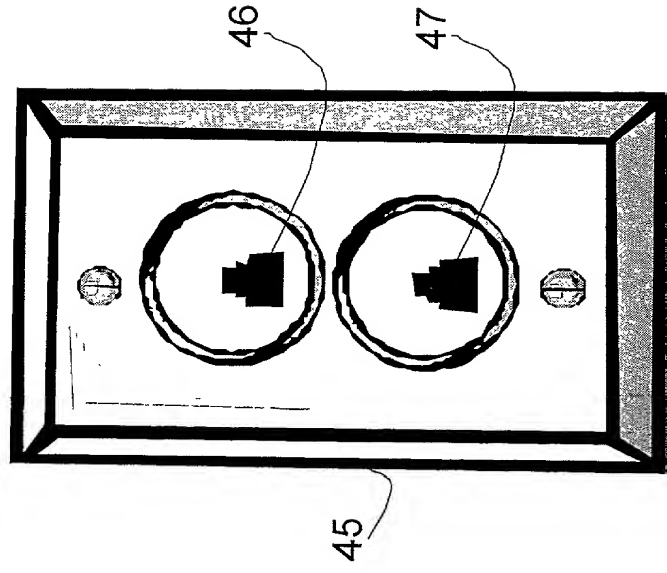


Fig. 6

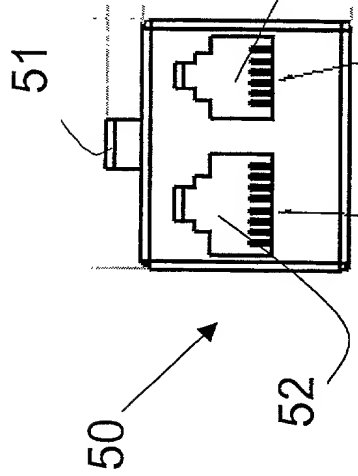


Fig. 7c

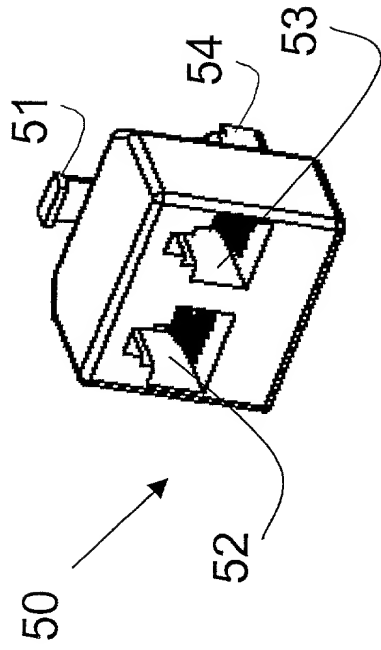


Fig. 7d

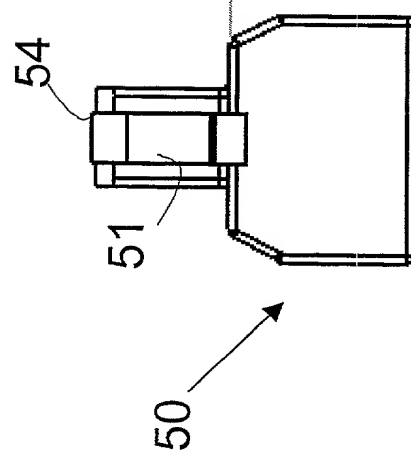


Fig. 7a

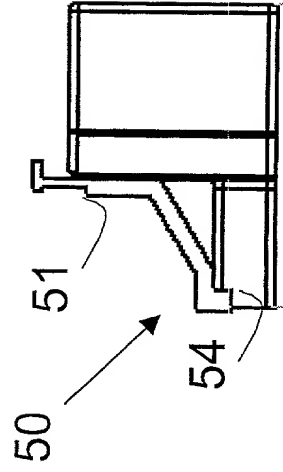


Fig. 7b

Combined Declaration for Patent Application and Power of Attorney

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name; and that I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

TELEPHONE COMMUNICATION SYSTEM AND METHOD OVER LOCAL AREA NETWORK WIRING

the specification of which (check one)

- ☒ is attached hereto
☐ was filed in the United States under 35 U.S.C. §111 on _____, as
 USSN _____*; or
☐ was/will be filed in the U.S. under 35 U.S.C. §371 by entry into the U.S. national stage of
 an international (PCT) application, PCT/ _____; filed _____,
 entry requested on _____*; national stage application received
 USSN _____*; §371/§102(e) date _____* (* if known),

and was amended on _____ (if applicable)

(include dates of amendments under PCT Art. 19 and 34 if PCT)

I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above; and I acknowledge the duty to disclose to the Patent and Trademark Office (PTO) all information known by me to be material to patentability as defined in 37 C.F.R. § 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §§ 119, 365 of any prior foreign application(s) for patent or inventor's certificate, or prior PCT application(s) designating a country other than the U.S., listed below with the "Yes" box checked and have also identified below any such application having a filing date before that of the application on which priority is claimed:

_____ (Number)	_____ (Country)	_____ (Day Month Year Filed)	<input type="checkbox"/> YES	<input type="checkbox"/> NO
_____ (Number)	_____ (Country)	_____ (Day Month Year Filed)	<input type="checkbox"/> YES	<input type="checkbox"/> NO

I hereby claim the benefit under 35 U.S.C. § 120 of any prior U.S. non-provisional Application(s) or prior PCT Application(s) designating the U.S. listed below, or under § 119(e) of any prior U.S. provisional applications listed below, and insofar as the subject matter of each of the claims of this application is not disclosed in such U.S. or PCT application in the manner provided by the first paragraph of U.S.C. § 112, I acknowledge the duty to disclose to the PTO all information as defined in 37 C.F.R. § 1.56(a) which occurred between the filing date of the prior application and the national filing date of this application:

_____ (Application Serial No.)	_____ (Day Month Year Filed)	_____ (Status : patented, pending, abandoned)
_____ (Application Serial No.)	_____ (Day Month Year Filed)	_____ (Status : patented, pending, abandoned)
_____ (Application Serial No.)	_____ (Day Month Year Filed)	_____ (Status : patented, pending, abandoned)

I hereby appoint the following attorneys, with full power of substitution, association, and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

SHERIDAN NEIMARK, REG. NO. 20,520 - ROGER L. BROWDY, REG. NO. 25,618 - ANNE M. KORNBAU, REG. NO. 25,884
 NORMAN J. LATKER, REG. NO. 19,963 - IVER P. COOPER, REG. NO. 28,005 - ALLEN C. YUN, REG. NO. 37,971*
 - * Patent Agent

ADDRESS ALL CORRESPONDENCE TO:

BROWDY AND NEIMARK, P.L.L.C.
 624 Ninth Street, N.W.
 Washington, D.C. 20001-5303

DIRECT ALL TELEPHONE CALLS TO:

BROWDY AND NEIMARK
 (202) 628-5197

The undersigned hereby authorizes the U.S. Attorneys or Agents named herein to accept and follow instructions from REINHOLD COHN AND PARTNERS as to any action to be taken in the U.S. Patent and Trademark Office regarding this application without direct communication between the U.S. Attorney or Agent and the undersigned. In the event of a change of the persons from whom instructions may be taken, the U.S. Attorneys or Agents named herein will be so notified by the undersigned.

Page 2 of 2


Atty. Docket:

Title: TELEPHONE COMMUNICATION SYSTEM AND METHOD OVER LOCAL AREA NETWORK WIRING

U.S. Application Filed _____, Serial No. _____

PCT. Application Filed _____, Serial No. _____

I hereby further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief and believed to be true; and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

FULL NAME OF FIRST INVENTOR BINDER, Yehuda		INVENTOR'S SIGNATURE 		DATE 18 SEP. 2000	
RESIDENCE 30 Yeshurun St., Hod Hasharon 45200, Israel		CITIZENSHIP Israeli			
POST OFFICE ADDRESS 30 Yeshurun St., Hod Hasharon 45200, Israel					
FULL NAME OF SECOND INVENTOR		INVENTOR'S SIGNATURE		DATE	
RESIDENCE		CITIZENSHIP			
POST OFFICE ADDRESS					
FULL NAME OF THIRD INVENTOR		INVENTOR'S SIGNATURE		DATE	
RESIDENCE		CITIZENSHIP			
POST OFFICE ADDRESS					
FULL NAME OF FOURTH INVENTOR		INVENTOR'S SIGNATURE		DATE	
RESIDENCE		CITIZENSHIP			
POST OFFICE ADDRESS					
FULL NAME OF FIFTH INVENTOR		INVENTOR'S SIGNATURE		DATE	
RESIDENCE		CITIZENSHIP			
POST OFFICE ADDRESS					
FULL NAME OF SIXTH INVENTOR		INVENTOR'S SIGNATURE		DATE	
RESIDENCE		CITIZENSHIP			
POST OFFICE ADDRESS					
FULL NAME OF SEVENTH INVENTOR		INVENTOR'S SIGNATURE		DATE	
RESIDENCE		CITIZENSHIP			
POST OFFICE ADDRESS					